Neutral Red as Redox Mediator in Microbial Electrochemical CO_2 Reduction

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An increase in atmospheric CO_2 content has been widely reported as one of the major causes of the rising of global temperature. Accordingly, the conversion of CO_2 to value-added products is of great interest for a cyclic carbon use. One of the promising approaches is using microorganisms as bio-electrocatalysts in microbial electrochemical systems. In this study, microbial electrocatalytic cells (MECs) containing *Methylobacterium extorquens* were investigated for their catalytic activities toward CO_2 reduction to formate *via* direct electron injection and redox mediator-assisted approaches [1]. A biocompatible dye, neutral red, was chosen as redox mediator and introduced into the systems in two different ways: homogeneous (dissolved in solution) and heterogeneous (electropolymerized onto the working electrode). The formation of the electropolymerized neutral red was confirmed by FTIR, UV/Vis and SEM measurements. The long-term electrochemical CO_2 reduction studies (upto 17 weeks) were performed by applying a constant potential of -0.75 V vs. Ag/AgCl under CO_2-saturated condition. During the electrolysis, formate formation was found as the only observed product with the average Faradaic efficiency of 2−6%. Further, the production rates and average Faradaic efficiencies were found to be higher in the cells having neutral red as mediator indicating the aid of neutral red in microbial electrocatalytic processes.

[1] H. Seelajaroen, M. Haberbauer, C. Hemmelmair, A. Aljabour, L. M. Dumitru, A. W. Hassel, N. S. Sariciftci, *ChemBioChem* **2019**, *20*, 1196.